ABSTRACT AND BIOGRAPHY

Verifications Under Uncertainty: Verifying Probabilistic Requirements

Requirements writers' jobs would be easier if they could assume that, for instance, a ground preparation crew will complete its task in exactly 17.435 days. In reality, often no one can tie down materials, environments, availabilities, reliabilities or much else with true certainty. Probabilistic requirements are written to cover those design areas that include such variabilities.

Probabilistic requirements are typically verified by analysis. Most often, Monte Carlo simulation models using variable inputs are used. But what do you do with the simulation output? It's not a single deterministic value, but instead a spreadsheet full of numbers. Several schemes have been used, most based on rules of thumb, some sub-optimal. Many do not address quantifiable risks correctly.

A team of design and systems engineers and statisticians assembled by the Constellation Chief Engineer's Forum tackled this common concern. Team recommendations included two broadly and easily applied probabilistic verification statement templates. This session will cover how to write and understand verification statements using the templates. It will also cover how to easily and correctly determine how many simulation trials are necessary to verify an engineering performance (physics-based) probabilistic requirement. "Consumer's risk" will be defined. Alternatives will be outlined for the case where the necessary number of trials cannot be performed, including how to quantify some risks involved in writing a waiver.

The target audience is any requirement writer, verifier, manager, design engineer or support statistician. We promise emphasis on illustration over math to keep the topic understandable, relevant and applicable to your project.

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Mr. Johnson is a general statistician and lead for the NESC Engineering Statistics Team of support experts drawn on by NESC assessment teams. He was a member of the Constellation Chief Engineer's Forum team working this topic. He previously supported Marshall Space Flight Center's Safety and Mission Assurance directorate in broad areas of general statistics and trending. Before that, he worked in quality, technical support and production management in polymer coatings and metals industries. He brings 20 years of quantitative quality experience to NASA. His areas of expertise include general data analysis, statistical quality analysis, test and experimental design and analysis and quantitative data mining.

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